

Physical Modeling of Nearshore Placed Dredged Material

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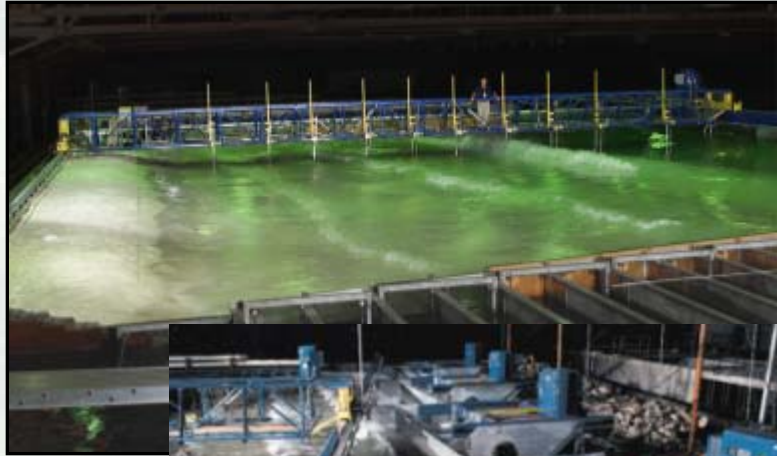
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Study Motivation

- The U.S. Army Corps of Engineers (USACE) continues to seek opportunities for the beneficial use of dredged material.
- Quantify benefits of nearshore dredged mound placement
- Determine movement of mound sediment
- Provide data for development of C2Shore numerical model



LARGE-SCALE SEDIMENT TRANSPORT FACILITY



- Large-scale facility with 18-m wide (cross-shore) by 30-m long (longshore) sand beach (0.15 mm median grain diameter)
- Waves produced by four synchronized wave generators oriented at a 10-degree angle to shoreline
- Wave-driven currents supplemented by an external recirculation system to simulate infinitely long beach
- Longshore sediment transport rate measured with traps installed at the down-drift boundary.



Mound Experiments

- Base case scenario was performed to measure the natural movement of sand and to help isolate the influence of each mound
- Mounds were located at approximate prototype depths of 11 (Mound 1) and 4 ft (Mound 2) relative to the still water level with a prototype height of 5 ft, and placement onshore (Mound 3) with a 10 ft prototype height.
- Each mound was dyed with a different color to increase the contrast between the placed material and the beach
- Incident wave conditions simulated at a 1:20 scale for an offshore incident wave height (H_{mo}) of 10.8 ft with a peak period of 6.7 sec and a breaking wave angle of ~6.5 degrees from shore normal.
- Each case was run for a prototype time of ~9 hours.

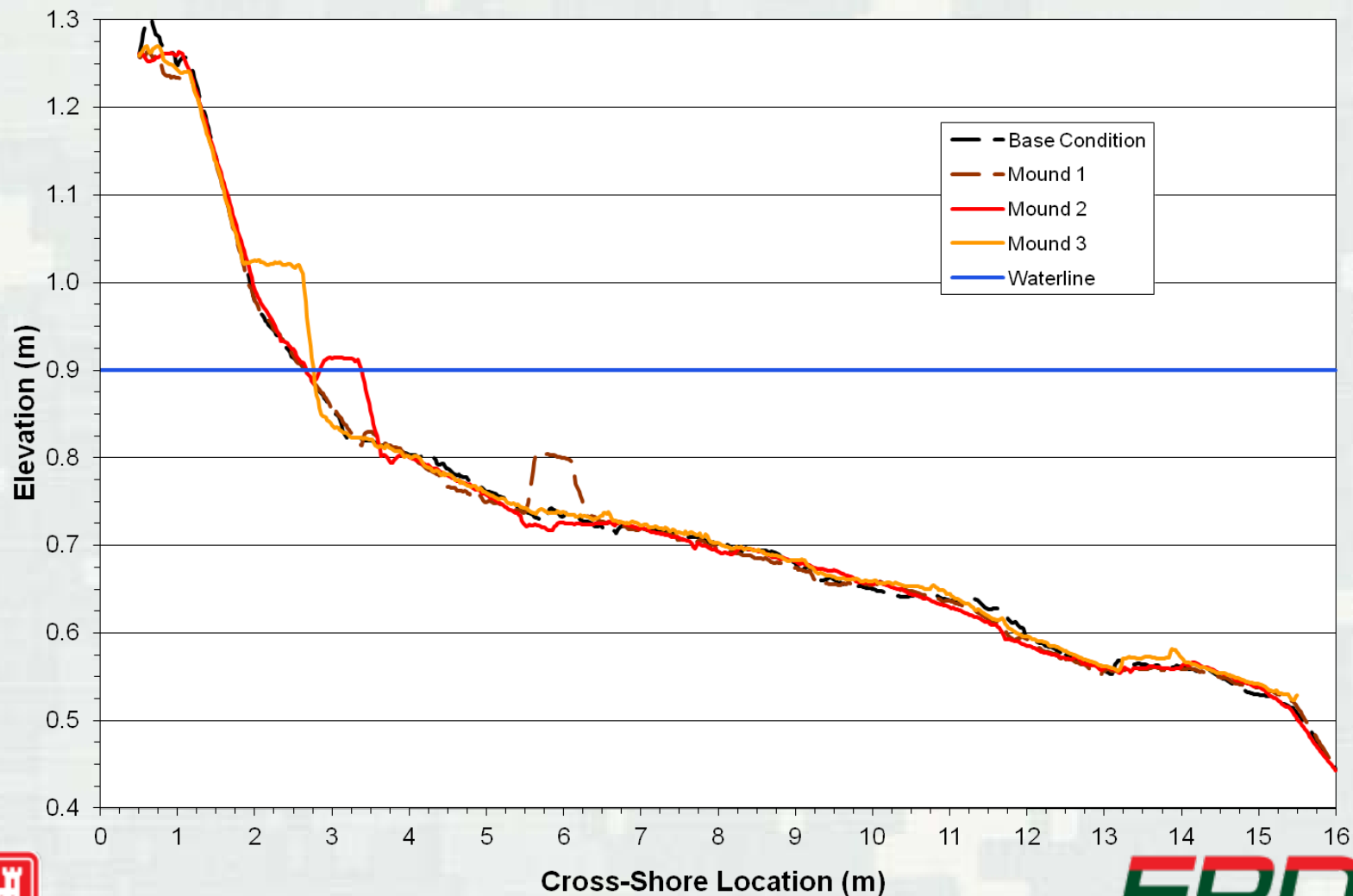


The plan view diagram illustrates the experimental setup. A 'Wave Absorber' is positioned at the top. Below it, four 'Wave Machine' units (#1 to #4) are spaced at 7.62 m intervals. The distance from the last wave machine to the 'Toe of Beach' is 10.0 m. The 'Toe of Beach' is located 9.0 m from the left boundary. The 'Pump Discharge' is located 15.0 m from the left boundary. The '20 Vertical Turbine Pumps' are located 10.0 m from the right boundary. The 'SWL' (Still Water Level) is indicated. The 'Mound 1' (brown), 'Mound 2' (red), and 'Mound 3' (orange) are located between Y30 and Y26. The horizontal axis is labeled 'X' and 'Y'.

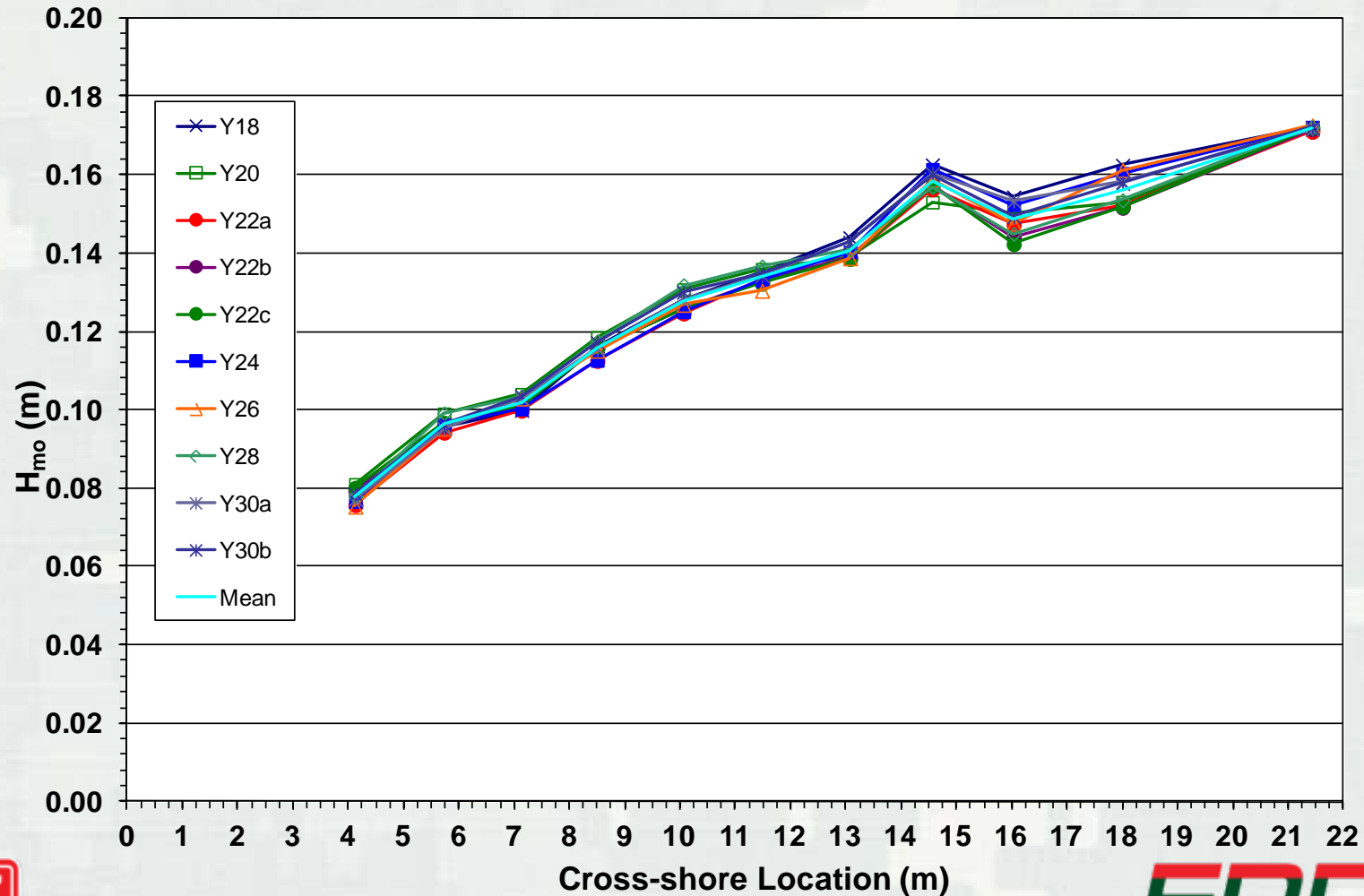


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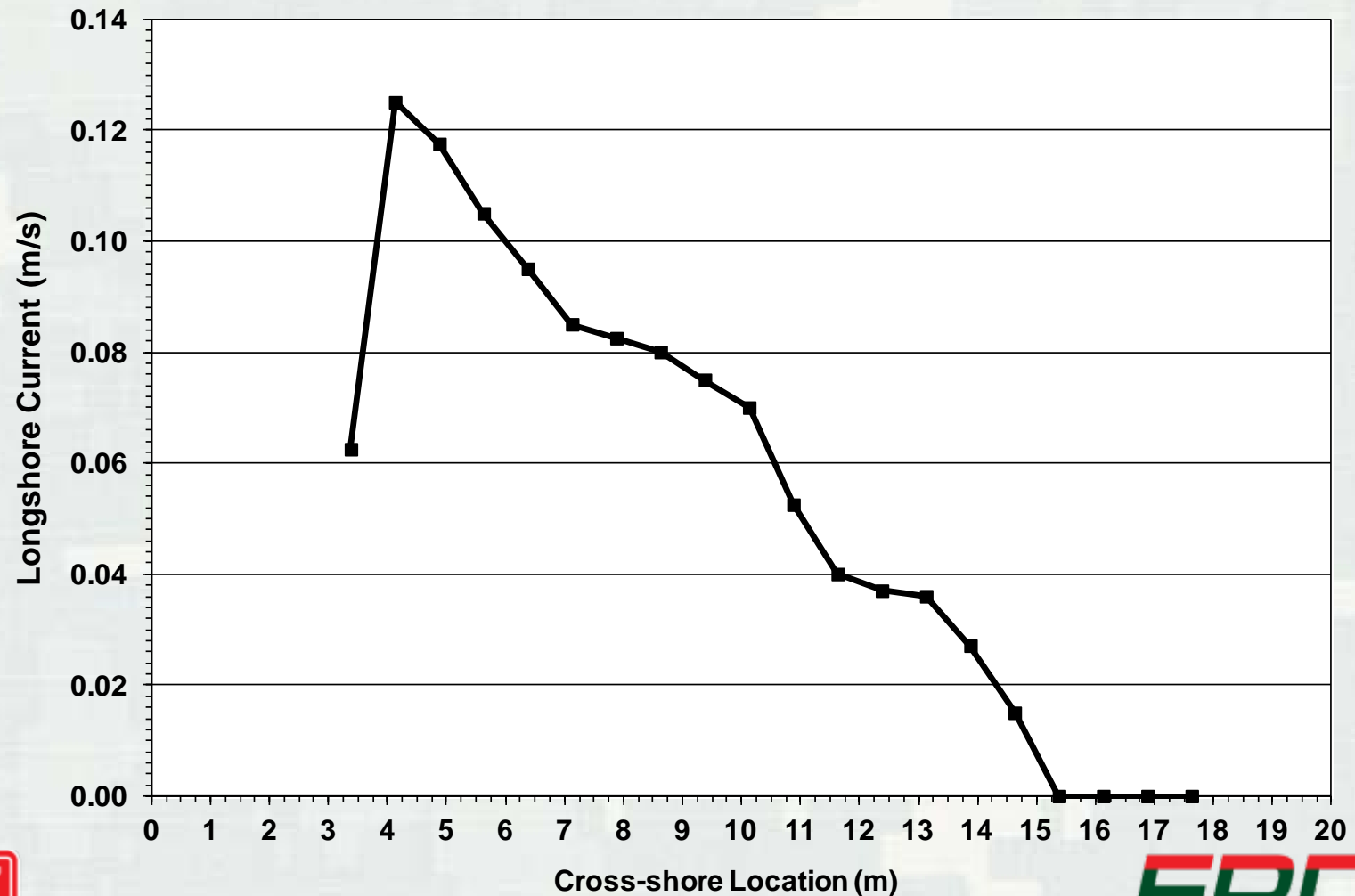
Mound Profiles



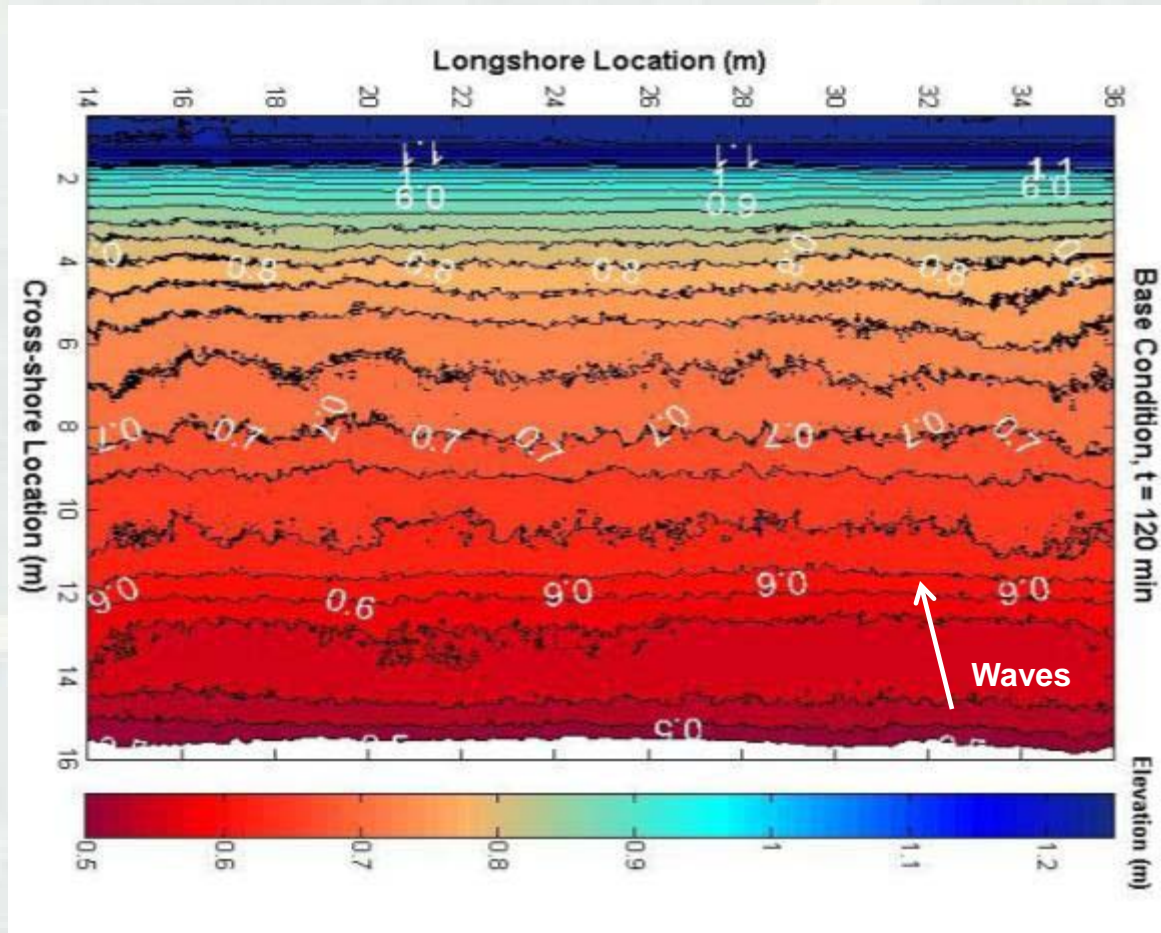
Base Condition Wave Heights



Base Condition Longshore Current



Base Condition

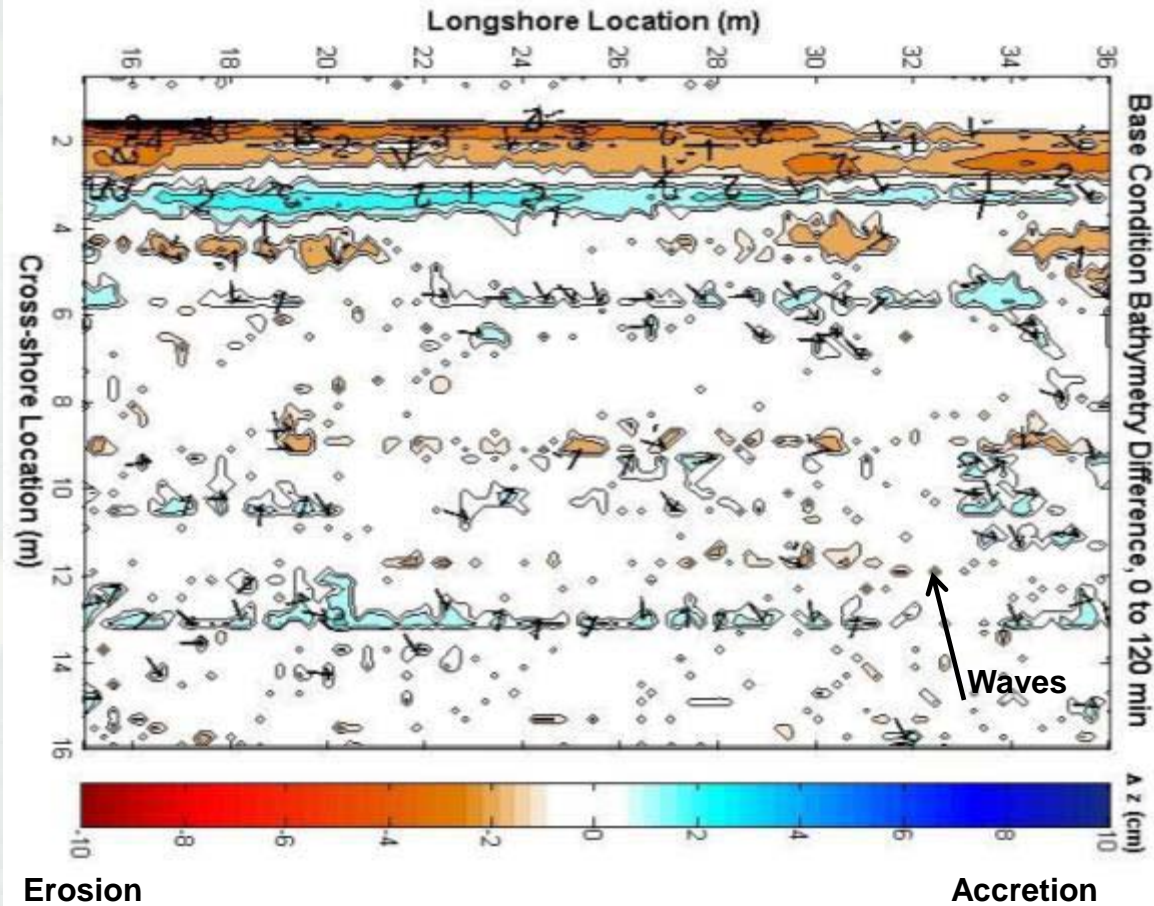


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Bathymetry Change



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Initial Mound Experiment



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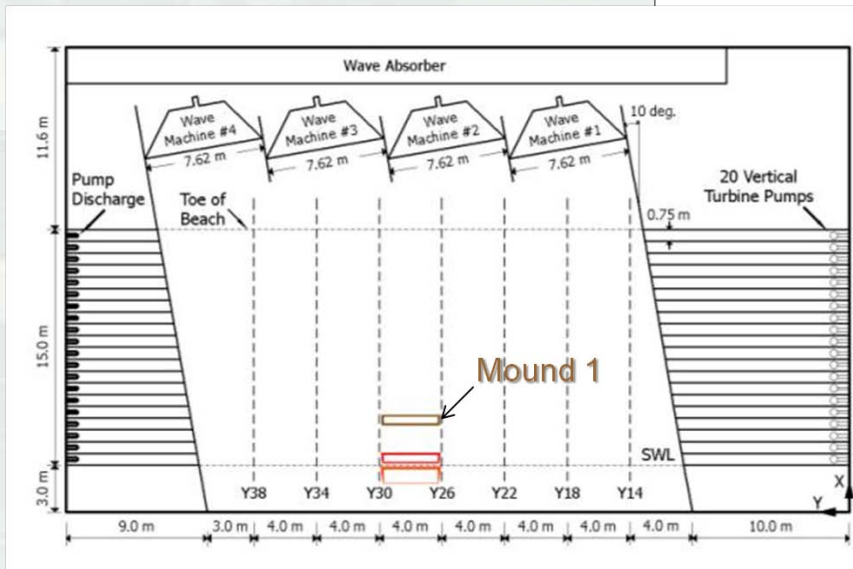
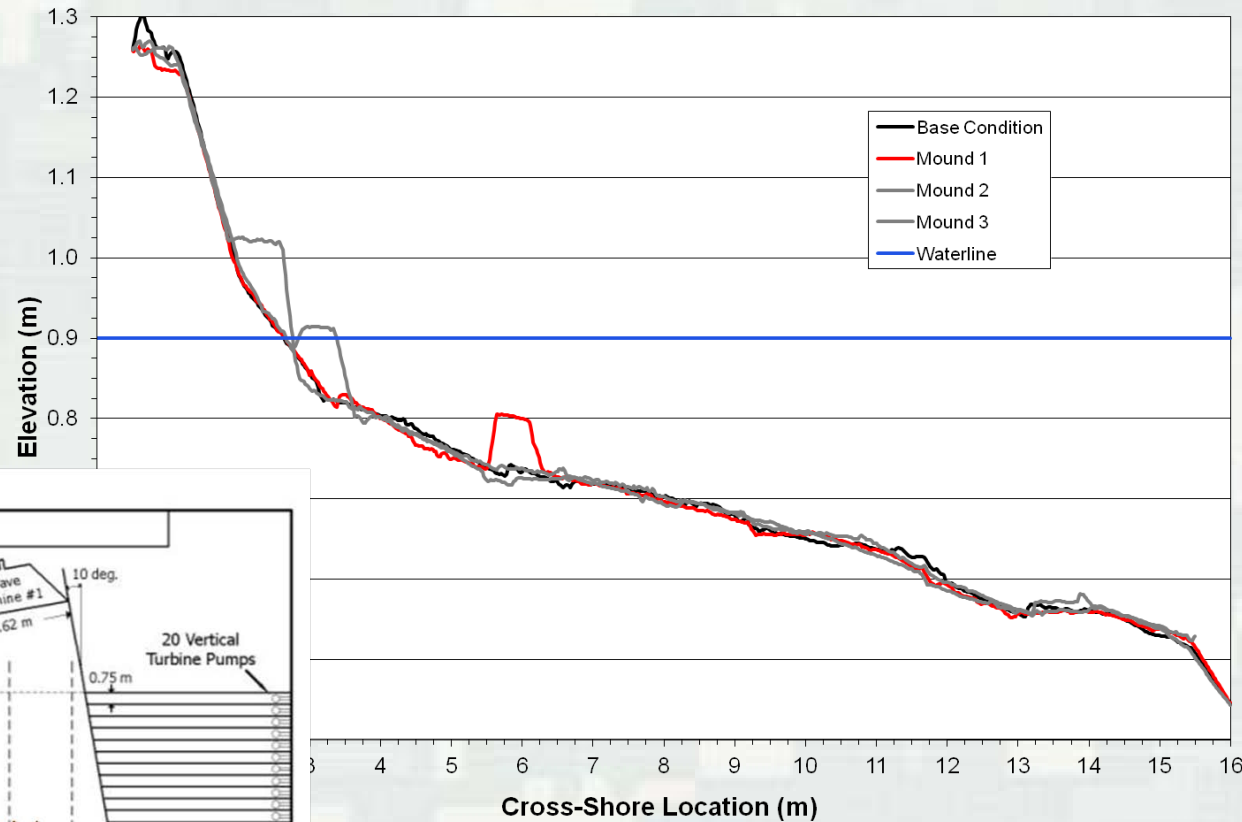
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Dyeing Sediment

- Provided contrast to natural sand
- Dyeing Procedure:
 - Sand mixed with liquid cement color until all sand was of uniform color.
 - The sand allowed to air dry and subsequently oven-baked at 70 to 80 deg C for a minimum of 24 hours.
 - After removal from oven, the sand was suitable to be placed on the beach for testing



Mound 1 Location

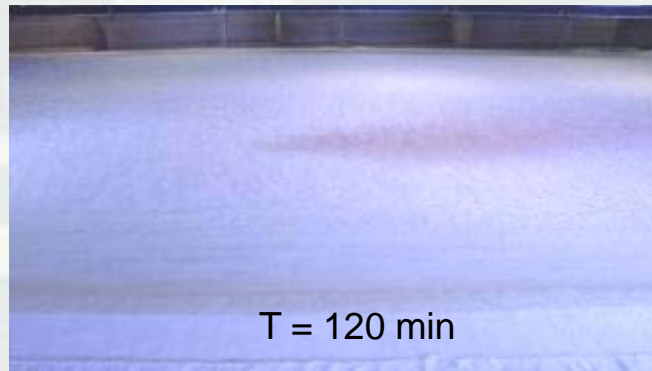
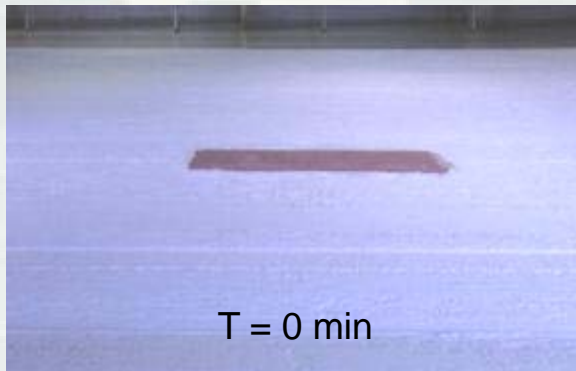


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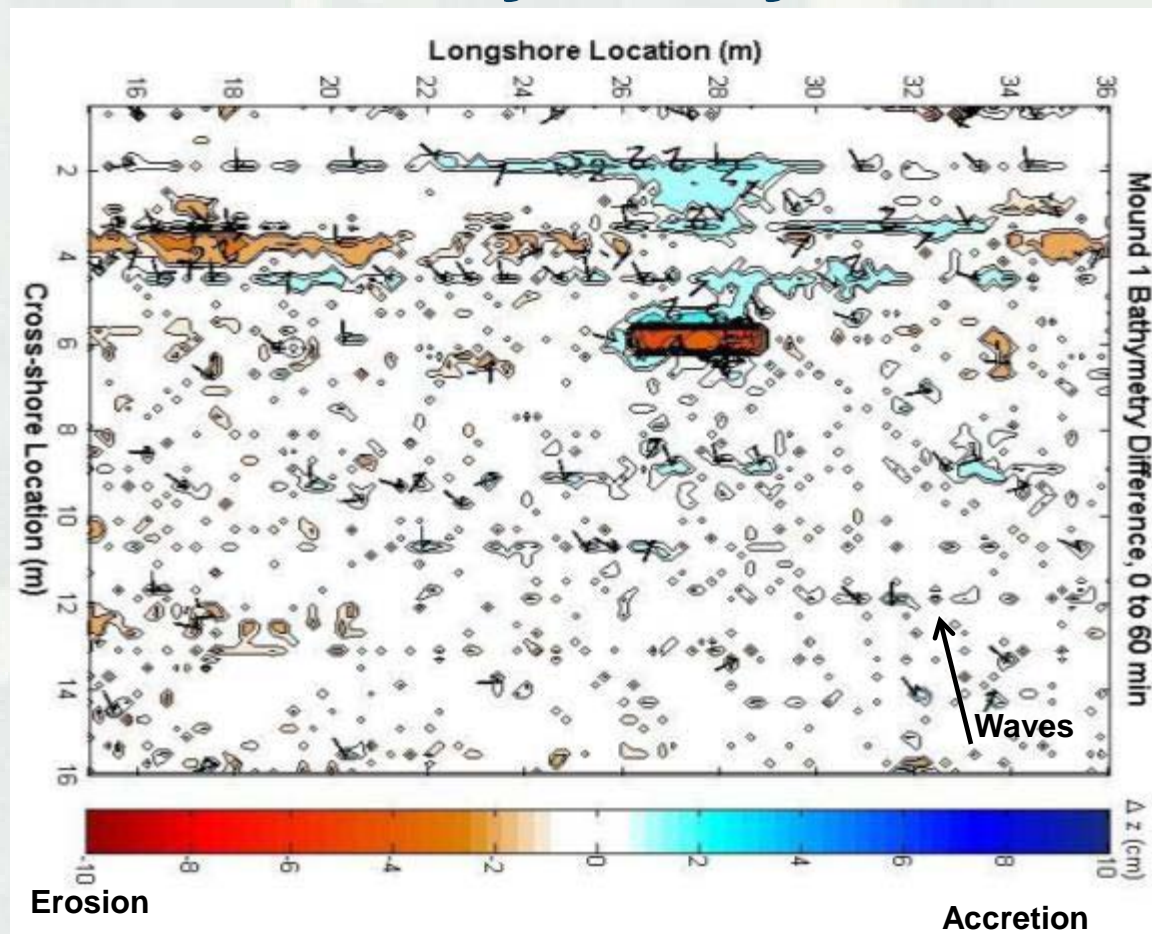
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Mound 1 after 120 minutes



Mound 1 Bathymetry Difference

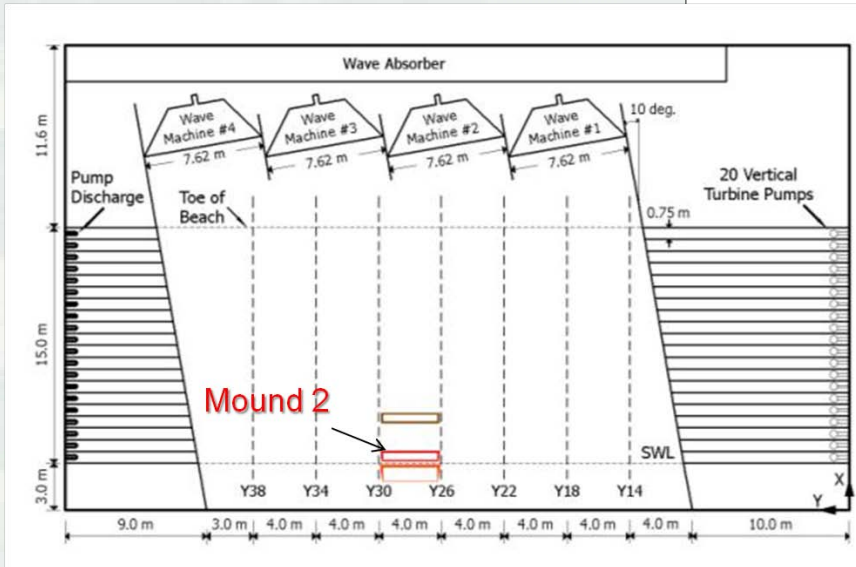
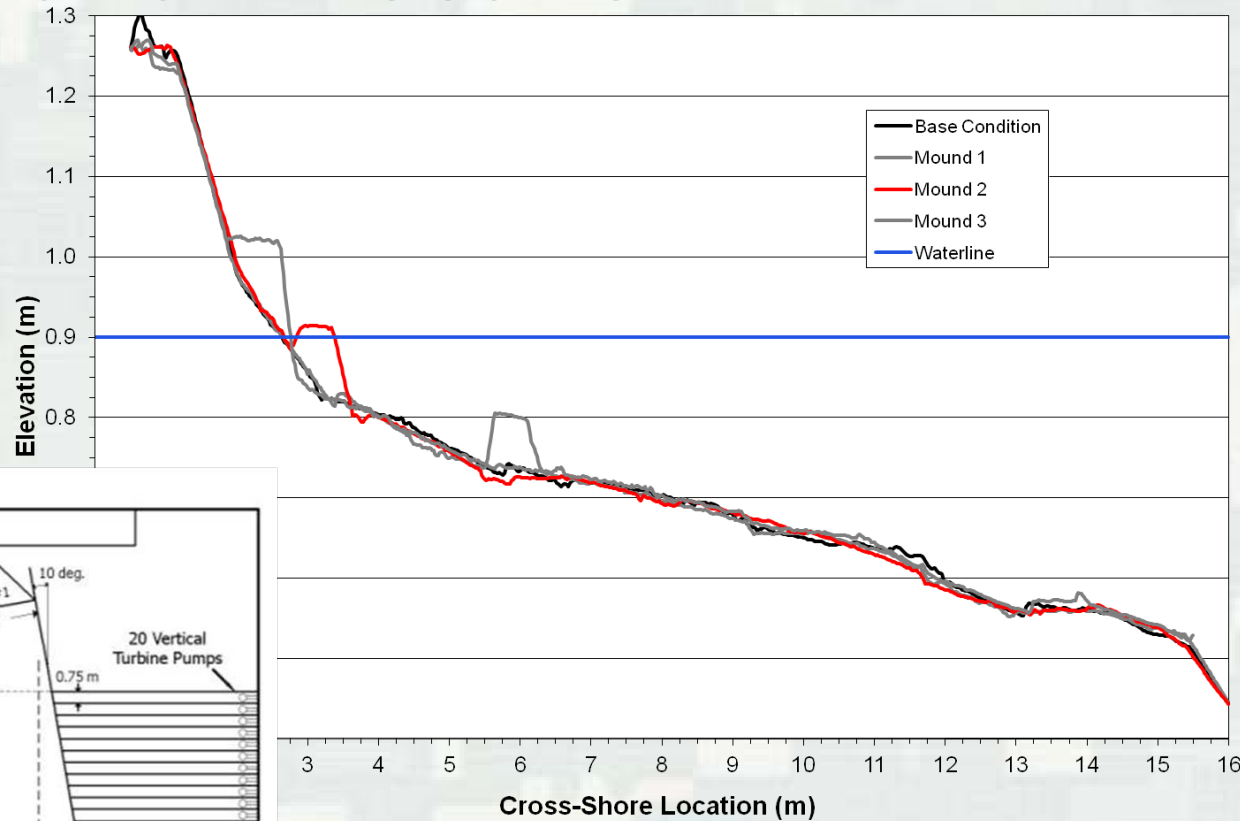


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Mound 2 Location

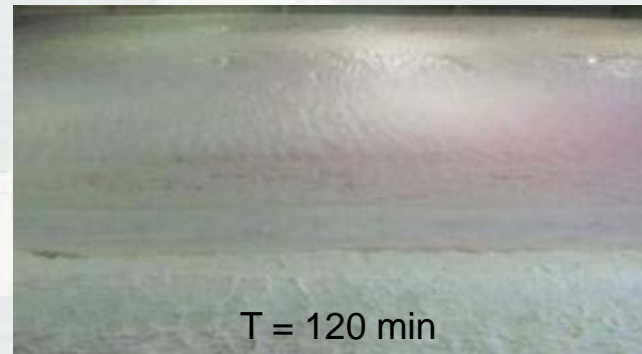
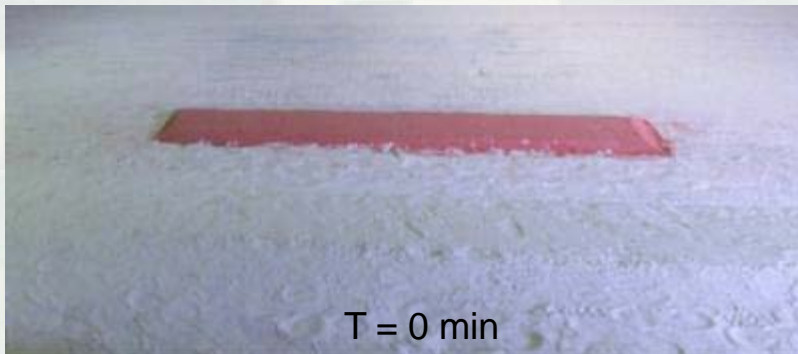


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Mound 2 after 120 minutes

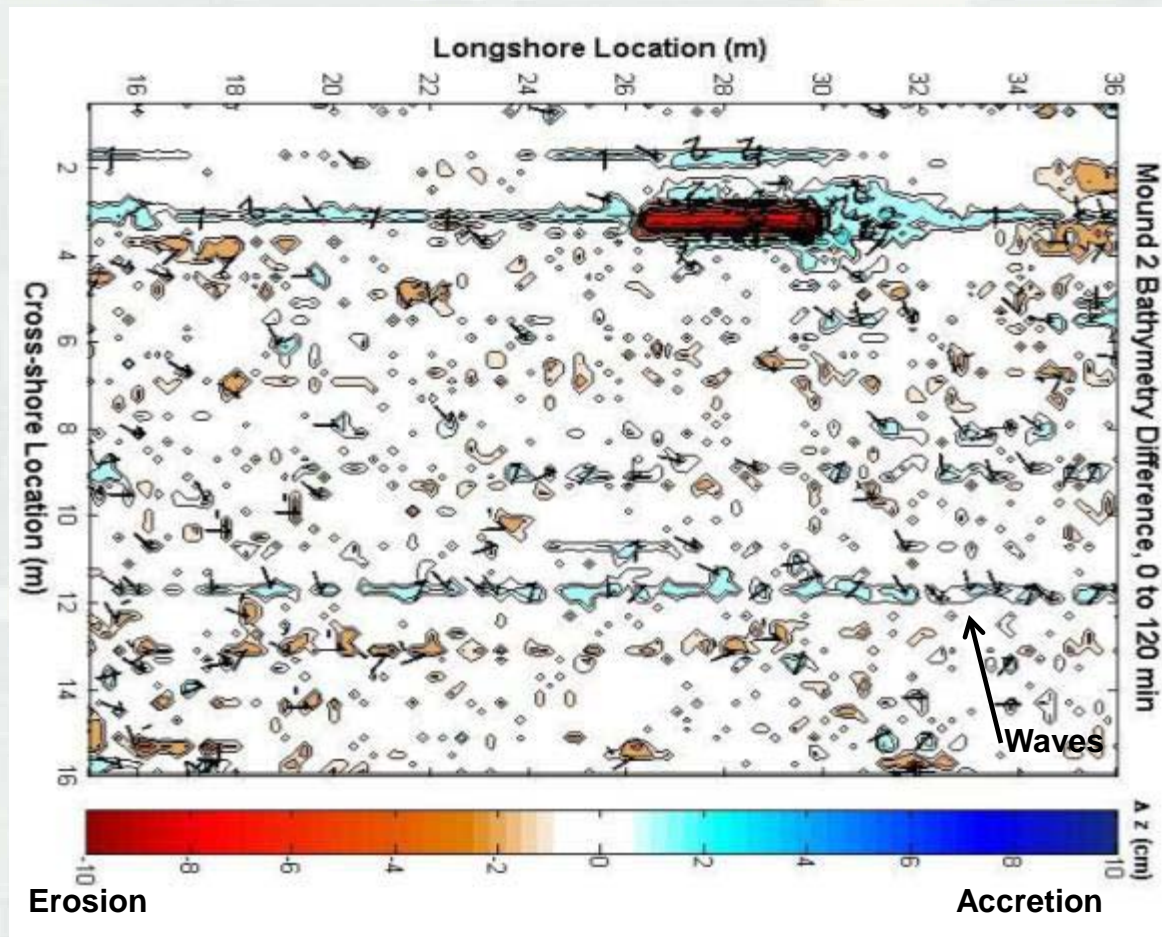


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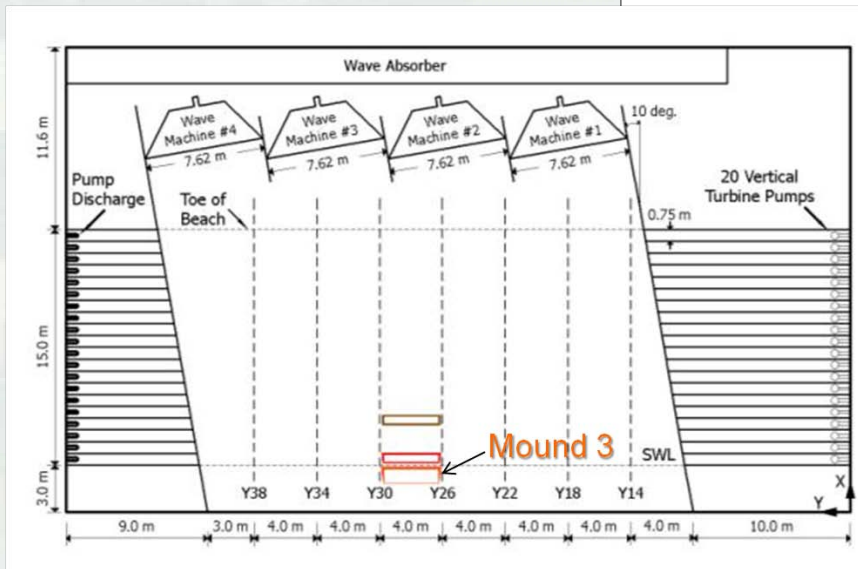
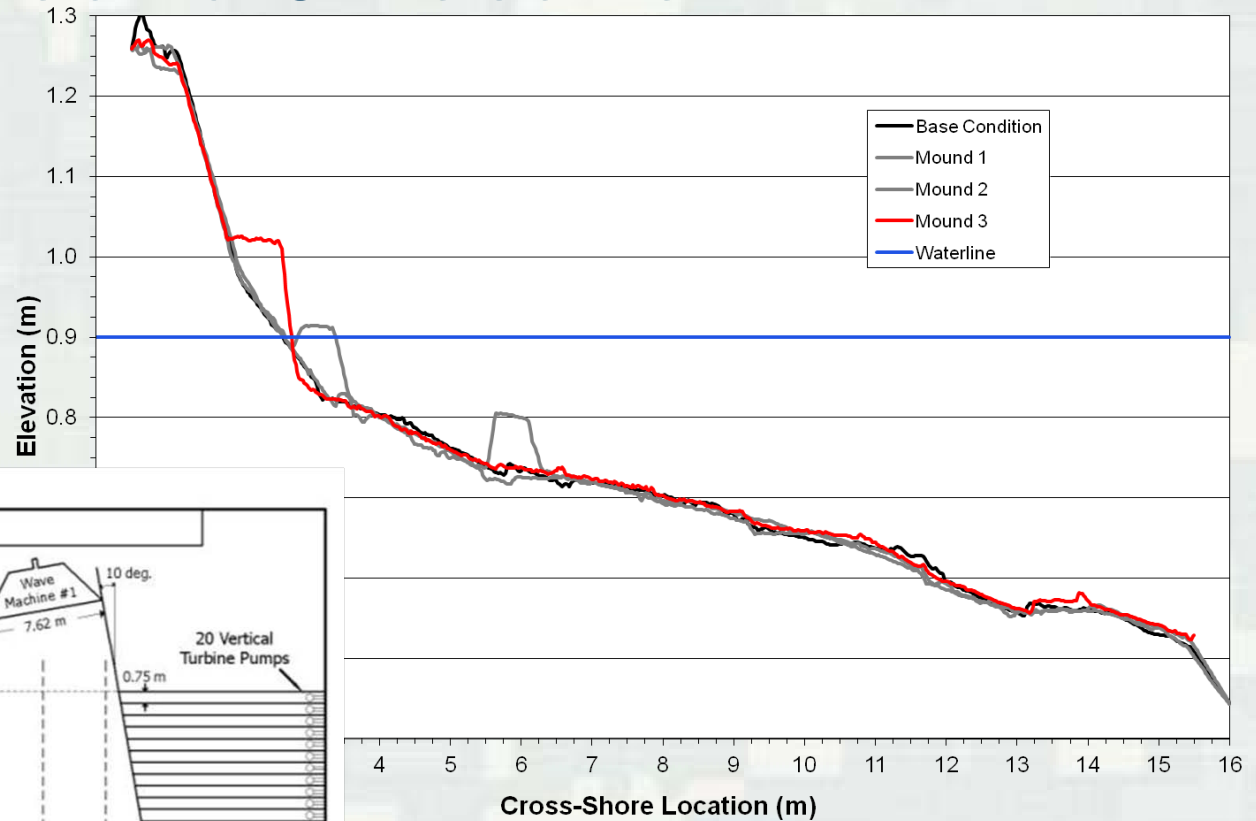
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Mound 2 Bathymetry Difference



Mound 3 Location

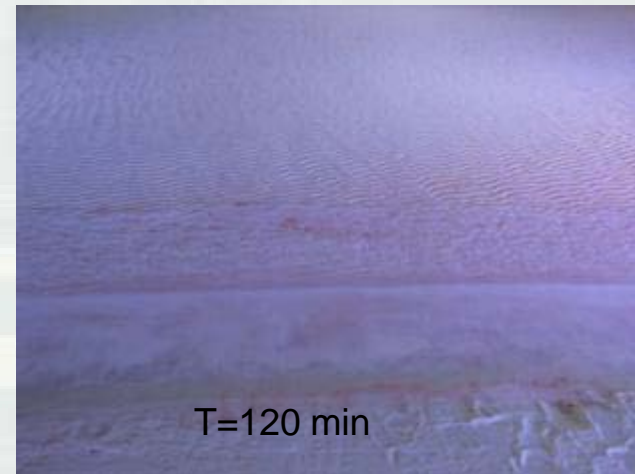
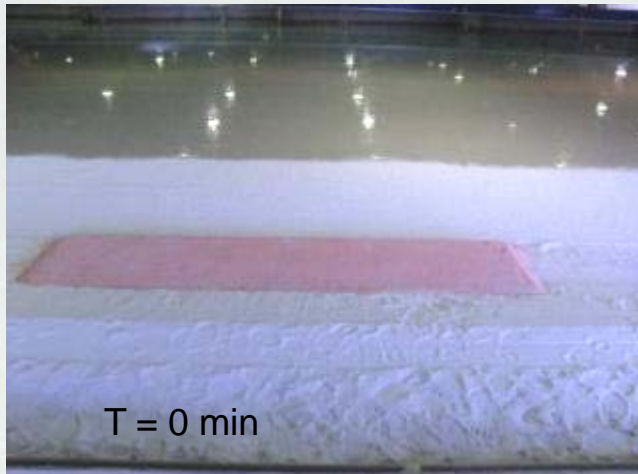


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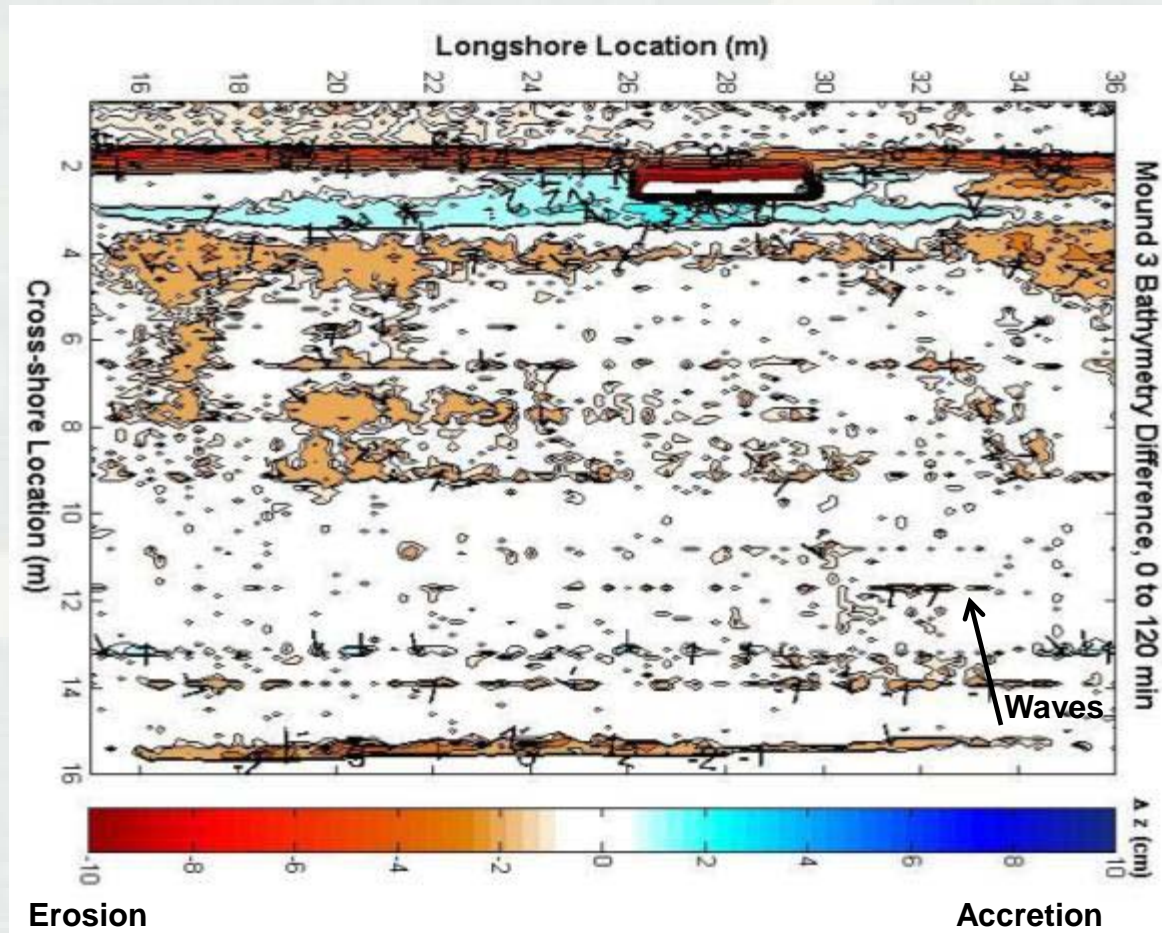
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Mound 3 after 120 minutes



Mound 3 Bathymetry Difference



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Conclusions

- Sand placed in the surf zone remained in the surf zone for the given wave conditions
- Accretion often occurred onshore of the mound due to sheltering
- Mound sand transported downdrift and onshore
- Dispersion and mixing occurred quickly for each case

